

## CLAIMS

What is claimed is:

1. In a reduction mill susceptible to damage by a non-frangible foreign object included within reducible material fed into the reduction mill along a predetermined path via a conveyor means, protective apparatus for providing a signal indicative of the presence of the non-frangible foreign object at a predetermined location along the predetermined path, comprising:

at least one sensing surface for traversing the flow of  
reducible material in said reduction mill and for receiving  
impactions of reducible material and foreign objects;

means for mounting said at least one sensing surface in operative relationship to said conveyor means and including means for vibrationally isolating said sensing surface from said reduction mill;

piezoelectric transducer means attached to said at least one sensing surface for providing output signals representative of the impactions of the foreign objects and the reducible material;

means coupled to said piezoelectric transducer means for selecting said foreign object impact signal from other signals

1 coupled thereto; and

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3 means coupled to said selection means responsive to said  
4 foreign object impact signal for generating a utilization  
5 signal useful for indicating the presence of said foreign  
6 object.

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8 2. The apparatus according to claim 1 wherein said  
9 selection means includes filter means coupled to said  
10 transducer means for selecting electrical signals within a  
11 predetermined bandwidth; and

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13 said utilization signal generator means includes threshold  
14 comparator means coupled to said filter means for receiving the  
15 output signal of said filter means and for providing a signal  
16 representative of a foreign object in said reducible material  
17 when the output signal of said filter means exceeds a  
18 predetermined threshold value.

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20 3. The apparatus according to claim 1 wherein said  
21 selection means includes first and second filter means coupled  
22 to said piezoelectric transducer means for providing electrical  
23 output signals; and said utilization signal generator means  
24 includes difference amplifier means coupled to receive said  
25 output signal from said first and second filter means for  
26 comparing said respective output signals and providing a signal

1       representative of a foreign object in said reducible material.

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3       4. The apparatus according to claim 2 wherein said sensing  
4       surface includes a single bar disposed within the reduction  
5       mill and traversing the width of the reducible material flow.

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7       5. The apparatus according to claim 3 wherein said sensing  
8       surface includes a single bar disposed within the conveyor  
9       means and traversing the width of the reducible material flow.

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11       6. The apparatus according to claim 2 wherein said sensing  
12       surface includes first and second bars for generating acoustic  
13       signals in response to impacts by said foreign object and said  
14       reducible material, each coupled to said piezoelectric  
15       transducer means for conversion to electrical signals  
16       representative of said foreign object and reducible material  
17       impacts.

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19       7. The apparatus according to claim 3 wherein said sensing  
20       surface includes first and second bars for generating acoustic  
21       signals in response to impacts by said foreign object and said  
22       reducible material, each coupled to said piezoelectric  
23       transducer means for conversion to electrical signals  
24       representative of said foreign object and reducible material  
25       impacts.

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2       8. The apparatus according to claim 7 wherein said  
3       electrical signals representative of said foreign object  
4       impacts provide a control signal to said reduction mill for  
5       reversing the direction of at least one conveyor;

6               thereby conveying the flow of said material away from a  
7       hammer roll.

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